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MUNG BEANS IN CALIFORNIA

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Because of the war, the supply of mung beans (Phaseolus aureus) from the Orient has been cut off. The prewar importations, though considerable, appear small on a national per capita basis, since the beans were consumed mostly by the Oriental population, in the form of bean sprouts. In the last few years there has been considerable interest in mung bean production in the United States, especially in Oklahoma and Texas, where some of the varieties were formerly used as green manure and as covercrops. Since California is an important bean-growing state, it is not surprising that efforts have been made to produce the crop here. In 1944 from 2,000 to 3,000 acres of mung beans were planted in California. So long as scarcity of seed keeps the prices high, as at present, the growers' interest is likely to continue. Thus far it has been a gambler's crop, and the producer and seed contractor have always won.

While the prices are still high, and production is increasing, we should learn something about this crop, its limitations and adaptations, and efficient methods of growing and harvesting it. Two possibilities may make the mung bean a commercial staple in California. First, if it can be produced efficiently, to compete in production with other beans, it may become permanently established. Second, if the sprouts find increasing use as a nutritious fresh vegetable for the American table, there will be a constant market and a permanent demand. If these two possibilities are realized, production can become steady and profitable. If they are not realized, mung beans may disappear from California agriculture after the war, even with a tariff in effect.

Cultural Practices

Mung beans are comparatively resistant to heat and drought. Conceivably, therefore, the crop might be grown without irrigation--an important advantage. This would require planting in April or early May to utilize the winter rains before the ground had dried out. In most cases observed in 1944, however, early plantings were not successful: trouble was encountered with cold soil, with consequent low germination; and in some sections, wireworms took a heavy toll. Slow growth is made by mung beans that are planted early. It seems now that a crop cannot well be produced on dry land unless the soil is fertile and has good moisture-holding capacity. For profitable crops, supplementary water should be provided either by irrigation or by the relatively high water tables often found in the river-bottom soils.

Field observations also indicate that early-planted mung beans are difficult to harvest because of their shattering. In this respect there is a considerable difference in varieties. If the plants ripen in late September or early October, there will be sufficient dew to dampen and toughen the pods if the cutting and piling is done in the early morning hours. If one attempts to harvest without benefit of dews, his losses from shattering may be disastrously large. For these reasons, May plantings on irrigated land are discouraged except under especially favorable conditions.

The rate of planting depends upon the variety used. If rows are 28 inches apart and the seeds are planted 3 inches apart in the row, the Indian mung bean 8256 would require about 12 pounds per acre; the Korean 8343, 7 pounds; and the Pusa 23, about 5. These differing rates of planting are due to seed-size differences in the varieties.

Varieties

Literally hundreds of mung bean varieties exist. About a hundred have been grown by the California Agricultural Experiment Station. Varieties differ, for example, in habit of growth, maturity, seed coat color, and seed size. Although some are used for summer covercrops, the greatest demand is for bean-sprout production. Since sprouters prefer the smooth, bright-green-seeded varieties, the brown, black, yellow, and other colors are here eliminated from consideration, as well as those which make extensive vegetative growth and are primarily adapted for covercrops. The green-seeded mung beans differ vastly, however, in their adaptation to California conditions. Seed from the Orient is not necessarily pure, for importations have often been a conglomerate mixture of varieties, a condition which leads to irregular germination. Because mung beans are self-fertilized, it is possible to select plants and, by progeny tests, to isolate pure strains, which can be increased for commercial plantings.

Mung beans have been grown in plots for a number of years at Davis and elsewhere. Table 1 gives results of the 1944 tests. In all, 14 varieties were tested; Korean 8343 was chosen as a check or control variety. Four divisions were made, each containing 5 varieties--the check and 4 others. Four yield experiments were

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TABLE 1

Plot Tests with Mung Beans at Davis in 1944*

Variety or source of seed	Agronomy Division accession no.	Pounds per acre	Seed† index	Height of plants (inches)
Oklahoma 12	4347	634	3.60	15 to 19
Indian	8254	600	3.17	5 to 10
Pusa 23	8394	1,052‡	3.31	23 to 29
Indian	8258	1,018	3.79	8 to 11
Indian	8257	1,102§	6.88	10 to 14
Chinese	8726	942	5.68	18 to 29
Chinese	8668	810	7.22	8 to 12
Manchurian	8700	1,104‡	4.76	12
K 853	8713	1,298‡	3.65	18 to 25
Cornelli Seed Co.	4349	1,218‡	4.30	19 to 20
La Choy Co.	8702	1,486‡	4.01	22 to 24
Indian	8255	1,372‡	5.63	12 to 26
Indian	8256	1,078‡	7.19	10 to 15
Korean (Check)	8343	734	4.14	10 to 16

*Planted May 18; rows 31 feet long, 36 inches apart, 4 rows to the plot, and yield based on the 2 middle rows.

†Seed index is the weight in grams of 100 beans.

‡Significantly larger yield than Korean check.

§This yield is not necessarily significant, although it is higher than Pusa 23 and Indian 8256; the three varieties were not tested under identical conditions.

planned to run side by side in the field. In each of these, the variety was replicated 5 times, in what is technically known as a "Latin square." This enables one to evaluate the yield data by statistical analysis and calculate the least difference that would be significant. The beans were planted May 18, probably 3 to 4 weeks earlier than necessary. Each plot was 4 rows wide and 31 feet long. The 2 middle rows were harvested. The plots were planted in 36-inch rows rather than the more desirable row width of 28 inches because the cultivation equipment at the Station is not adapted to standard bean rows. The plots were irrigated by the furrow method twice, on July 8 and July 25. In table 1 the varieties in which the yield was significantly larger than the Korean 8343 (check) are indicated by an asterisk. None of the 13 varieties was significantly lower than the check variety in yield, but a number were higher.

A few notes may be added about the varieties tested in 1944. Oklahoma 12 was badly infected with mosaic. The seed size and the yield were both small, and therefore it does not show particular promise. Indian 8254 is a selection with small seeds. The extreme dwarfness of the plants precludes the possibility of a high yield and therefore the selection is inferior. Pusa 23 is a vigorous, moderately high-yielding type. In a planting at Biggs, it produced a profitable crop. If the small seed is acceptable to the trade, this variety may find a place in mung bean production. Indian 8258 produced a fair crop in the test. The pods are light brown, the seed is small, and the plants are dwarf. The seed size, too, is variable, requiring further selection. It is doubtful if this selection can compete effectively with some of the others for a place in California production. Indian 8257 is very similar to 8256. Chinese 8726 has fairly large seed. The yield was not heavy, and it was segregating for "fig" leaf, in which the leaflets are lobed rather than entire as in most mung beans. If a "fig" leaf selection could be made that is otherwise acceptable, the character would be a valuable identification feature in the field. Chinese 8668 has large black pods and large seeds. It is not as vigorous as the other Chinese variety, and the yield does not equal the large-seeded Indian 8256, so it does not seem promising. Manchurian 8700 has medium-sized seed and fair yield. It may become important if sprouters want a medium-sized seed. K 853 is a selection that was introduced many years ago at the Station. It is vigorous but is in need of further selection as it is segregating for "fig" leaf. The selection 4349 from the Cornelli Seed Company gave a fair yield. It was grown near Marysville in a commercial planting and was found to shatter too badly to be useful. The selection 8702 from the La Choy Company gave the highest yield of any variety tested in 1944. The plant size was above the average. The foliage was light green and the pods light brown. It is in need of further selection because the seed size is variable. At present it looks promising. The Indian 8255 has medium-sized seed, is a high yielder, is worthy of further testing, and may become important if Indian 8256 is too large. Indian

8256 has already been increased by the Station for distribution. It was significantly higher in yield than Korean 8343, in the variety tests. If large seed is in demand among sprouters, the variety may become important. In a planting on unirrigated land near Marysville, it did very poorly in comparison with the Korean, indicating it is less drought resistant. The Korean 8343 has been grown widely. A large portion of the commercial acreage in 1944 was very likely this variety, although this would be hard to trace due to the informal way seed has been distributed. Since it is widely accepted, the time is ripe for an increase of seed of known purity. Two photographs of this variety in commercial production are shown in figure 1,[2] as grown on dry land, and figure 2, on irrigated land. A harvesting scene is illustrated in figure 3.

Five of the varieties had been tested for yield in 1943, with the results as summarized in table 2. Yields for the same varieties in 1944 appear in table 1.

TABLE 2

Yield Tests with Mung Beans at Davis and Marysville in 1943

Variety	Agronomy Division accession no.	Seed index (Davis)	Yield at Davis, pounds per acre	Yield at Marysville, pounds per acre
Indian	8255	5.29	922	1,465
Pusa 23	8394	3.54	806	810
Manchurian	8700	4.61	988	1,000
Indian	8256	6.85	1,102	1,748
Korean	8343	4.26	990	1,155

*Based on single-plot yields.

The limited yield testing that has been made to date, although important, is not sufficient to serve as a guide for commercial growers of mung beans. As already noted, some of the present varieties are not very uniform. In order to obtain pure seed stocks for the growers, two seed increases were made by the Station, in 1944, of two varieties chosen for their uniformity. One was Korean 8343; the other the large-seeded Indian 8256. From these increase plantings there are now about 20 sacks of seed of each variety, which the Station will make available (as far as the limited amounts will allow) to producers desiring pure seed. It is proposed that these lots be considered as foundation seed from which certified seed can be produced.

Sprouters still disagree somewhat regarding the size of the ideal mung bean seed. For this reason two types were increased; and unless the situation clears up, others can be added, such as the small-seeded Pusa 23. It appears more practical to release to the growers more varieties of pure seed than may eventually be necessary than it is to wait for the sprouters to make a unanimous decision.

[2]The three photographs used in this leaflet were furnished through the courtesy of C. M. Volkman and Company.

Sprouting Mung Beans in the Home

In sprouting the beans, a few precautions are advisable. Heat, carbon dioxide, and other products of metabolism are generated during the sprouting process. These are controlled by sprinkling the germinating beans with water, which lowers the temperature and washes away the accumulation of gases. The germinating chamber should have ample drainage for air and water, and should allow rapid removal of the wash water so that the sprouts are not flooded.

The germinating chamber may be a 12-inch flower pot with muslin in the bottom to prevent the beans from falling through the drainage hole. During germination, the pot should have a loose-fitting wooden or metal lid to exclude the light. The best temperature for germination is 65° to 75°F. The water used to sprinkle the beans should be lukewarm.

Soak about a pint of mung beans over night, wash them with running water, and pour them into the germinating chamber. They should cover the bottom of the pot to a depth of about 2 inches. Sprinkle the beans every 4 or 5 hours with about 2 gallons of lukewarm water (65° to 70°F). At night, 8 hours may elapse between washings if the room is allowed to cool. The sprouts should be ready for use in 4 or 5 days; they are then about 2 inches long. Remove them and wash them in a tub of running water to float off the seed coats. The ungerminated seed and the unusable fragments will remain in the bottom of the tub.

Fig. 1.--A mature mung bean plant growing without irrigation. The size of the plant and pods can be judged by comparison with the ruler.

Fig. 2.--A view of a field of mung beans. The vines later covered the rows. This field was irrigated twice.

Fig. 3.--A view of a bean harvester threshing mung beans.

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